AMENDMENTS TO THE CLAIMS

Please enter the below claim amendments.

1. (currently amended) An apparatus comprising:

a heat spreader;

a silicon die; and

a thermal interface material (TIM) disposed between the heat spreader and the silicon die comprising a plurality of metals capable of forming a transient liquid phase bond **such that the metals form a eutectic alloy**.

2. (original) The apparatus of claim 1 wherein the thermal interface material comprises tin (Sn) and bismuth (Bi).

3. (original) The apparatus of claim 1 further comprising a substrate attached to the silicon die.

4. (original) The apparatus of claim 3 further comprising a seal disposed between the heat spreader and the substrate to encapsulate the thermal interface material and the silicon die.

5. (original) The apparatus of claim 1 further comprising an adhesion barrier material disposed between the silicon die and the thermal interface material.

6. (original) The apparatus of claim 5, wherein the adhesion barrier material comprises a metal selected from the group consisting of titanium (Ti), chromium (Cr), titanium-nitride (TiN), tantalum (Ta), or tantalum-nitride (TaN).

7. (original) The apparatus of claim 1 wherein the heat spreader comprises a metal selected from the group consisting of copper, black diamond, or black diamond copper composite.

8. (original) The apparatus of claim 7 further comprising an adhesion barrier material disposed between the heat spreader and the thermal interface material.

9. (original) The apparatus of claim 8, wherein the adhesion barrier material comprises a metal selected from the group consisting of titanium (Ti), chromium (Cr), titanium-nitride (TiN), tantalum (Ta), or tantalum-nitride (TaN).

10. (original) The apparatus of claim 1, wherein the thermal interface material is comprised of a first metal selected from the group consisting of tin (Sn), nickel (Ni), copper (Cu), silver (Ag), or gold (Au).

11. (original) The apparatus of claim 1, wherein the thermal interface material is comprised of a second metal selected from the group consisting of bismuth (Bi), lead (Pb), tin (Sn), indium (In), silver (Ag), gold (Au), or cadmium (Cd).

12. (original) The apparatus of claim 1, wherein at least one of the plurality of metals in the thermal interface material is diffused within another metal.

13. (currently amended) A process comprising:

attaching a silicon die to a substrate;

depositing a thermal interface material on at least one of the silicon die and a heat spreader; and

attaching the heat spreader to the silicon die, wherein the thermal interface material comprises a plurality of metals capable of forming a transient liquid phase bond, **the bond being a eutectic alloy comprising the metals**.

14. (original) The process of claim 13 wherein depositing the thermal interface material on at least one of the silicon die and a heat spreader comprises depositing a base metal and an interlayer metal on at least one of the silicon die and a heat spreader.

15. (original) The process of claim 14 wherein attaching the heat spreader to the silicon die comprises heating the thermal interface material to a predetermined bonding temperature such that the plurality of metals diffuses within one another, and wherein the predetermined bonding temperature is below the melting temperature of each of the plurality of metals.

16. (original) The process of claim 15 wherein heating the thermal interface material further comprises selecting the predetermined bonding temperature to range from approximately 100 degrees Celsius to approximately 200 degrees Celsius.

17. (original) The process of claim 14 wherein depositing the base metal further comprises selecting the base metal from the group consisting of tin (Sn), nickel (Ni), copper (Cu), silver (Ag), or gold (Au).

18. (original) The process of claim 14 wherein depositing the interlayer metal further comprises selecting the interlayer metal from the group consisting of bismuth (Bi), lead (Pb), tin (Sn), indium (In), silver (Ag), gold (Au), or cadmium (Cd).

19. (original) The process of claim 13 further comprising depositing an adhesion barrier material on the silicon die prior to depositing the base metal on the heat spreader.

20. (original) The process of claim 13 further comprising depositing an adhesion barrier material on the heat spreader prior to depositing the base metal on the heat spreder.

21. (original) The process of claim 13 further comprising sealing the heat spreader and the substrate together to enclose the silicon die and the thermal interface material.

22. (currently amended) An apparatus comprising:

a heat spreader;

a substrate;

a silicon die attached to the substrate; and

a bonding material that bonds the heat spreader to the silicon die, wherein the bonding material comprises metals capable of forming a transient liquid phase bond, **wherein the bonding material is formed at a temperature lower than the melting point of the metals**.

23. (original) The apparatus of claim 22 wherein the heat spreader comprises a metal selected from the group consisting of copper, black diamond, or black diamond copper composite.

24. (original) The apparatus of claim 22 wherein the silicon die has a thickness in the range of approximately 50 microns to approximately 200 microns.

25. (original) The apparatus of claim 22 wherein the bonding material comprises tin (Sn) and bismuth (Bi).

26. (original) The apparatus of claim 22 wherein the bonding material has a thickness in the range of approximately 1 micron to approximately 100 microns.

27. (original) A method comprising:

depositing a first metal on a silicon die and a heat spreader;

depositing a second metal on the first metal;

attaching the silicon die to a substrate; and

bonding the heat spreader to the silicon die, wherein the first and second metals form a transient liquid phase bond when heated for a predetermined time at a predetermined bonding temperature, wherein the bonding temperature is less than the melting temperature of the first and second metals.

28. (original) The process of claim 27 further comprising dispensing a sealant between the substrate and the heat spreader to enclose the silicon die and the transient liquid phase bond.

29. (original) The process of claim 27, wherein depositing the first metal further comprises depositing tin (Sn) having a thickness in the range of approximately 2 microns to approximately 50 microns.

30. (original) The process of claim 27, wherein depositing the second metal further comprises depositing bismuth (Bi) having a thickness in the range of approximately 0.1 microns to approximately 1 micron.

31. (original) The process of claim 27 wherein bonding further comprises selecting the predetermined bonding temperature to range from approximately 30 degrees Celsius to approximately 200 degrees Celsius.

32. (original) The process of claim 26 wherein bonding further comprises selecting the predetermined time to range from approximately one hour to approximately twenty-four hours.

33. (currently amended) A system comprising:

a processor comprising a heat spreader, a silicon die, and a thermal interface material disposed between the heat spreader and the silicon die comprising a plurality of metals capable of forming a transient liquid phase bond, **wherein at least one of the plurality of metals in the thermal interface material is diffused within another metal**; and

a ~~parallel~~ **parallel** data bus coupling the processor to at least one input/output device.

34. (currently amended) The system of claim [[~~32~~]] **33** wherein the thermal interface material comprises a metal selected from the group consisting of bismuth (Bi), lead (Pb), tin (Sn), indium (In), silver (Ag), gold (Au), copper (Cu), nickel (Ni), or cadmium (Cd).

35. (currently amended) The system of claim [[~~32~~]] **33** further comprising a volatile memory.